

REMARKS ON THE GENERA *ALBURNUS* AND *ALBURNOIDES* AND
DESCRIPTION OF A NEOTYPE FOR *ALBURNUS ALBIDUS* (COSTA, 1838),
SENIOR SYNONYMOUS OF *ALBURNUS VULTURIUS* (COSTA, 1838)
(PISCES, CYPRINIDAE).

by

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SUMMARY. — The southern Italy bleak *Alburnus albidus* Costa, 1838, (type locality : Alento River, Campania, SW Italy) senior synonymous of *Alburnus vulturius* Costa, 1838, is redescribed on the basis of specimens collected in several localities. A neotype was selected from 33 specimens collected in the type locality. The northern bleak *Alburnus alburnus alborella* De Filippi, 1844, is endemic to northern Italy and the western Balkans up to Lake Scutari in Albania. The genus is absent in central and in far southern peninsular Italy and islands. Several affinities between *A. albidus* and the related genus *Alburnoides* were observed. A decreasing cline in number of branched anal and pelvic rays of *Alburnoides bipunctatus* was found from North to South. However, in the Balkans and in Greece, revision of *A. bipunctatus* group of subspecies is badly needed.

RESUME. — L'ablette du sud de l'Italie *Alburnus albidus* Costa, 1838 (localité-type : Rivière Alento, Campanie, Italie du SW), synonyme senior d'*Alburnus vulturius* Costa, 1838, est redécrite à partir de spécimens récoltés dans plusieurs localités. Un néotype a été choisi parmi 33 spécimens recueillis à la localité-type. L'ablette du nord *Alburnus alburnus alborella* De Filippi, 1844 est endémique de l'Italie du nord et de l'ouest des Balkans jusqu'au lac Scutari en Albanie. Le genre est absent en Italie centrale et sud et dans les îles. Des affinités ont été observées entre *A. albidus* et le genre voisin *Alburnoides*. Une diminution du nombre des rayons mous de l'anale et de la pelvienne a été mise en évidence du nord au sud. Cependant, dans les Balkans et en Grèce, une révision des sous-espèces d'*Alburnoides bipunctatus* est nécessaire.

RIASSUNTO. — La specie *Alburnus albidus* Costa, 1838, (loc. tip. : Fiume Alento, Campania) sinonimo prioritario di *Alburnus vulturius* Costa, 1838, viene ridescritta sulla base di materiale raccolto in diverse località dell'Italia meridionale. Un neotipo è stato scelto tra 33 esemplari raccolti nella località tipica. L'*alborella* settentrionale, *Alburnus alburnus alborella* De Filippi, 1844, è endemica nel nord d'Italia e nei Balcani occidentali fino al lago di Scutari in Albania. Il genere manca nell'Italia centrale, nell'estremo sud e nelle isole. Le molte affinità riscontrate tra *A. albidus* e specie del genere consimile *Alburnoides*, inducono a formulare ipotesi interpretative. Viene osservato un cline decrescente per i raggi divisi della pinna anale in popolazioni di *Alburnoides bipunctatus* le cui sottospecie tuttavia, risultano mal definite nei Balcani e in Grecia.

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INTRODUCTION

Costa (1838), described the cyprinid fish *Leuciscus albidus* from Staffoli torrent, a small tributary of the Alento river in Campania region (Cilento mountains, SW Italy). This description is incomplete and the figures not quite adequate. All type material was long since lost in Naples.

The taxonomic status and range of *Alburnus albidus* was misunderstood by many authors, from Günther (1868), Canestrini (1874), Gatti (1897), Scotti (1898) and Berg (1932), up to Maitland (1977).

The author recently has the opportunity to collect several specimens of this species in the type locality. It is therefore possible to give a redescription of this much discussed species and to designate a neotype. A revision of *Alburnus alburnus alborella* (De Filippi, 1844) was also carried out.

MATERIAL AND METHODS

Alburnus albidus material, was compared with specimens from several populations of *Alburnus vulturius*, the status of which was studied by Bianco (1978) ; from one population of *Alburnus alburnus alburnus* Lin. ; from one of *Alburnus alburnus alborella* De Fil. ; and from three populations of *Alburnoides bipunctatus* Bloch

The measurements were taken using dial calliper and compasses as follow, and then expressed as percentages of the standard length. Total length : tip of snout to the end of caudal fin placed horizontally. Standard length (SL) : tip of snout to dorsal origin of caudal fin. Preorbital distance : tip of snout to anterior margin of orbit ; interorbital : width between orbits taken superiorly ; preventral : tip of snout to anterior origin of pelvic fin (left side) ; predorsal : tip of snout to anterior origin of dorsal fin ; P-V : anterior origin of pectoral to anterior origin of pelvic (left side) ; V-A : anterior origin of pelvic to anterior origin of anal fin. Length of head : tip of snout to posterior-most margin of operculum (membrane included) ; mouth : tip of inferior maxilla to lip corner ; caudal peduncle : posterior origin of anal fin to ventral origin of caudal fin ; fins : anterior origin to the end of longest ray (longest fin for paired). Depth of head : at posterior margin of occipitum ; body depth : at anterior origin of dorsal fin. Eye diameter : taken horizontally.

The meristic counts were taken as follow. Number of branched ray for fins. Number of scales on lateral line : all those pored from head to caudal region. Number of scales above lateral line : from anterior origin of dorsal fin to lateral line row (not included). Number of scales below lateral line : from anterior origin of pelvic to lateral line row (not included). Number of gillrakers : counted for the first gill arch (left side).

Examined material

Alburnus albidus. Neotype, 113 mm SL, from author's collection, IZA Cat. no. 7899, Campania, Cilento, Alento river near Fasana village (SA), Italy, 24/6/1978, P.G. Bianco and G. Fusac-

chia coll. ; 32 specimens, 58-112 mm SL, Museo Civico di Storia Naturale di Verona CI 1007, same date, river and collectors.

Alburnus vulturius. One specimen, 88 mm SL, IZA 78105, Campania, Paestum, Sele river, Italy, 26/6/1978, P.G. Bianco and G. Fusacchia ; 3 specimens, 67-76 mm SL, IZA 78106, Basilicata, Policoro, Sinni river, Italy, 3/7/1978, P.G. Bianco and L. Carrara ; 4 specimens, 76-89 mm SL, IZA 78103, Puglia, Foggia, Celone river, Italy, 19/7/1977, P.G. Bianco ; 17 specimens 45-88 mm SL, IZA 78102, Molise, Gambatesa, Fortore river, Italy, 17/6/1977, P.G. Bianco ; 2 specimens, 74-90 mm SL, IZA 78100, 20/3/1977 and 6 specimens, 44-108 mm SL, IZA 78107, 5/9/1975, Molise, Campomarino, Saccione river, Italy, P.G. Bianco ; 11 specimens, 46-78 mm SL, IZA 78101, Molise, Torrefruna, Trigno river, Italy, 10/7/1977, P.G. Bianco.

Alburnus alburnus alborella. 14 specimens, 62-77 mm SL, IZA 78109, 7/2/1976 and 15 specimens, 62-74 mm SL, IZA 78108, 25/6/1977, Umbria, Orvieto scalo, Paglia river, Italy, P.G. Bianco (acclimatized population).

Alburnus alburnus alburnus. 12 specimens, 75-111 mm SL, IZA 784, Lac Portile de Fier, Romania, 1976, P. Banareescu.

Alburnoides bipunctatus bipunctatus. 6 specimens, 36-65 mm SL, IZA 78113, Mraconia river, SW Romania, 22/9/1975, P. Banareescu ; 13 specimens, 40-65 mm SL, IZA 78114, Tur river near Porumbesti, NW Romania, 24/9/1967, P. Banareescu.

Alburnoides bipunctatus thessalicus. 8 specimens, 32-68 mm SL, IZA 78110, Pindo, Kalam-paka, Pinios (or Peneios) river, Greece, 28/8/1977, P.G. Bianco.

Alburnoides bipunctatus. 2 specimens, 53 and 65 mm SL, IZA 78111, Epiro, Ioannina lake, Greece, 23/2/1976, fish market.

Alburnus bipunctatus eichwaldi. 4 specimens, 43-70 mm SL, IZA 7814, Maku, small tributary of the Tigris, Iraq, 29/6/1975, P.G. Bianco.

Alburnus albidus Costa, 1838

Leuciscus albidus Costa, 1838 : 16, Tab. XIV. — Valenciennes, 1844, Hist. Nat. Poissons, XVIII : 245. — Günther, 1868, VII : 314.

Alburnus albidus : Berg, 1932 : 149. — Berg, 1949 : 299. — Banareescu, 1964 : 374. — Ladiges and Vogt, 1965, Süss. Eur., p. 141. — Muus and Dahlstrom, 1967, Eur. Fersk., p. 118, Fig. 72. — Blanc, Banareescu, Gaudet and Hureau, 1971, Eur. Wat. Fish, Fig. 102. — Maitland, 1977 : 158.

Leuciscus vulturius Costa, 1838 : 17, Tab. XV. — Tenore, 1844 : 4, Tab. I.

Alburnus albidus vulturius : Sommani, 1951 : 191, Fig. 2-3-4.

Alburnus vulturius : Tortonese, 1970 : 264, Fig. 106. — Bianco, 1978 : 31, Fig. 1.

Alburnus alborella : Canestrini, 1874 : 15. — Gatti, 1897 : 173. — Scotti, 1898 : 45. (not De Filippi).

Alburnus scoranzoides : Fang, 1942, Bull. Mus. natn. Hist. nat., XIV : 171 (not Heckel & Kner).

GENERIC STATUS

The general habitus of *Alburnus albidus* is similar to that of *Alburnoides* spp. in respect to body and caudal peduncle depth (see Tab. I and II), in the presence (in some cases) of small blackish spots along the lateral line and in the terminal, not upturned position of the mouth (see Fig. 2, C and D). Also, from meristic and biometric counts, I place the species in *Alburnus* for the following reasons: the number of gill rakers recorded here on the first gill arch (Tab. V) and given also by other authors (Berg, 1949; Oliva, 1950; Banarescu, 1964 etc. see lit. cit.), is 5-10 in *Alburnoides* but 13-26 in *Alburnus* (*Alburnus albidus*, 13-19); the mandibular length is greater in *Alburnoides* and without overlap in mean values (\pm SD); the same is true for the longest ray of the dorsal and anal fins of *Alburnoides*, in comparison with *Alburnus albidus* and «*A. vulturius*» (Tab. I and II). The same holds for populations of *Alburnus alburnus*, in which mouth, dorsal and anal length again allow separation of the two genera. Most other morphometric measurements do not differ significantly between *Alburnus* and *Alburnoides*, but a significant difference exists in preorbital distance and eye diameter, being larger in *Alburnoides*. In both genera a scaleless keel extends from before the vent to the base of the pelvic fins, although in *Alburnoides* this is sometimes scaleless only posteriorly (*Alburnoides oblongus*). The pharyngeal tooth formula is 2.5-5.2 in *Alburnus*, but 2.5-4.2 usually in *Alburnoides*.

DESCRIPTION OF THE NEOTYPE



Fig. 1. — Neotype of *Alburnus albidus*, 144 mm total length, IZA 7899.

Female, 113 mm SL, Alento river, Campania, IZA 7899 (Fig. 1).

— *Fin ray formula*: dorsal III - 8, anal III - 12, pectoral II - 15, pelvic I - 7, caudal 19. (fide Costa: *Alburnus albidus*, dorsal 2 - 10, anal 14, pectoral 17, pelvic 14 (misprint), caudal 18; *Alburnus vulturius* (from Monticchio lakes S Italy), dorsal 9, pectoral 14, pelvic 8-9, caudal 18. Fide Tenore (1844): *Alburnus vulturius* (Monticchio), dorsal 8, anal 13-15, pectoral 11, pelvic 8, caudal 24).

— *General morphology*: mouth terminal, not upturned, eye diameter equal to pre-orbital space, insertion of dorsal fin at vertical midpoint between anal fin origin

and pelvic insertion, distal edge of dorsal and anal fins straight (the anal sometimes concave), pelvic and pectoral fins rounded. Caudal fin deeply forked, the hind edge triangular. A slight protuberance on the area near the nostrils. A marked gibbosity at the posterior end of occiput. Pharyngeal teeth 2.5-5.2, hooked and serrated. Gill rakers on the first (left) gill arch 15. Keel scaleless. Measurements expressed in % of standard length are given in Tab. I.

– *Colour in preserved specimens* : dark brown on dorsal part of body, a dark stripe sometimes discernible from upper insertion of operculum to the end of caudal peduncle. Lower part of body silvery, covered by embedded but deciduous scales. Some dark pigment spots on scales of lateral line and on rows above, sometimes extending to one or two rows of scales below lateral line. All fins are whitish, with minute dark spots scattered on the surface.

– *Colour when alive* : dorsal region iron blue dark, ventral region silvery (base of pectoral and anal fins reddish in males during the spawning season). Iris yellow, but brown on the upper portion.

– *Distribution* : the same as given by Bianco (1978) for *Alburnus vulturius*. One can add that the species is absent in rivers to the south of the Alento and Sinni rivers (see Fig. 3).

Tabl. I – Measurements in % of standard length of *Alburnus* (mean value) ; in parenthesis \pm standard deviation.

CHARACTER	<i>A. a. alburnus</i>	<i>A. a. albonella</i>	" <i>A. vulturius</i> "	<i>A. albidus</i>	<i>A. albidus</i> Neotype
Space					
Preorbital	5.63(0.22)	6.14(0.41)	6.67(0.49)	5.97(0.33)	6.19
Interorbital	7.07(0.42)	7.76(0.36)	7.99(0.53)	8.72(0.46)	8.67
Predorsal	57.31(1.48)	56.74(1.40)	56.43(1.32)	57.88(1.39)	58.85
Preventral	45.73(1.23)	47.56(1.26)	48.43(1.10)	47.88(1.17)	47.26
Length					
Head	22.14(0.62)	23.83(1.14)	25.53(1.12)	23.11(0.82)	23.80
Mouth	5.37(0.24)	6.27(0.28)	6.13(0.60)	5.74(0.39)	5.49
Caudal peduncle	14.37(0.92)	15.26(1.11)	16.70(1.22)	16.12(1.30)	17.22
Dorsal fin	19.16(0.98)	21.24(1.07)	21.90(1.46)	20.33(1.03)	20.00
Anal fin	15.03(0.76)	16.39(0.98)	16.55(1.39)	15.32(1.00)	14.87
Ventral fin	15.43(1.52)	15.90(0.90)	16.83(1.60)	16.24(1.77)	15.93
Depth					
Head	15.97(0.58)	17.54(0.73)	18.64(0.78)	18.21(0.80)	18.21
Body	25.70(1.26)	24.30(1.28)	26.77(2.30)	27.00(1.41)	28.05
Caudal peduncle	10.13(0.66)	10.20(0.51)	12.11(0.82)	11.26(0.62)	11.50
Distance					
P – V	23.47(0.83)	24.75(1.09)	23.80(1.34)	24.61(1.32)	23.63
V – A	21.39(1.63)	21.15(1.30)	21.30(1.66)	22.45(1.05)	23.00
Eye diameter	6.41(0.36)	7.08(0.51)	6.92(0.62)	5.95(0.29)	6.02

Alburnus alburnus alborella De Filippi, 1844

- Cyprinus alburnus* : Pollini, 1816, Verona, p. 21 (not Linneus).
Leuciscus alburnus : Valenciennes, 1844, Hist. Nat. Poissons. XVII : 272.
Aspius alborella De Filippi, 1844 : 402.
Alburnus alborella : Heckel & Kner, 1858, Süßwasserf., p. 137, Fig. 171. — Nardo, 1860, Prosp. Sist. Pesci, I : 73. — De Betta, 1862, Itt. Veron., p. 81. — Canestrini, 1866, Arch. Zool., p. 84. — Fatio, 1882, Faune Vert. Suisse, Poissons, I, p. 440. — Bettoni, 1884, Prod. Fauna Bresc., p. 210. — Festa, 1892 : 92. — Scotti, 1897 : 45. — Ninni, 1907, Pesci prov. Venezia e Treviso, p. 38. — Supino, 1916, Pesci d'acqua dolce, p. 48, Tab. XV. — Holly, 1926, Zool. Anz., p. 218. — Malfer, 1927, Il Benaco, p. 196. — Gridelli, 1936, Pesci Venezia Giulia, p. 104.
Alburnus alburnus alborella : Karaman, 1928, Glasnik Skop., p. 152. — Banareescu, 1964 : 373, Fig. 159. — Tortonese, 1968, Picc. Fauna Italia, p. 51. — Tortonese, 1969 : 1772. — Tortonese, 1970 : 262, Fig. 105.
Alburnus alborella laterstriga Canestrini, 1866, Arch. Zool. p. 87. — Canestrini, 1874 : 15.
Aspius alburnus : Bonaparte, 1841, Fauna Ital., Pesci, XXX, Tab. 116, Fig. 5.
Leubiscus alburnellus Martens, 1857, Wieg. Archiv., p. 151 and 179, Fig. 6.
Alburnus alburnellus : Günther, 1868, VII : 313. — Giglioli, 1880 : 45, n. 421.
Alburnus fracchia Heckel & Kner, 1858, Süßwasserf., p. 138. — Giglioli, 1880, Elenco, p. 45, n. 420. — Canestrini, 1874 : 15.
Alburnus scoranza Heckel & Kner, 1858, Süßwasserf., p. 138. — Vinciguerra, 1933, Ann. Mus. st. Nat. Genova. p. 309.
Alburnus alburnus scoranza : Karaman, 1924 : 47. — Vladykov & Petit, 1930, Bull. Soc. Zool. Fr., p. 403.
Alburnus scoranzoides Heckel & Kner, 1858, Süßwasserf., p. 139. — Günther, 1868, VII : 315. — Steindachner, 1892 : 367.
Alburnus albidus alborella : Berg, 1932 : 149. — Pomini, 1937, Boll. Pesca, Piscic. Idrobiol., p. 289. — Oliva, 1950 : 249.

DISTRIBUTION

The range given by Berg (1932) for the bleaks of Italy was not correct because he considered the northern *Alburnus* as a subspecies of the then little known *Alburnus albidus* from southern Italy. The classification of Berg misled all subsequent authors.

The taxonomic position of *Alburnus alburnus alborella* was discussed by Tortonese (1970). We can add some comments and remarks on distribution. The original range of *A.a. alborella* was distorted by several controlled and uncontrolled introductions in lakes and river basins almost throughout Italy. On the Adriatic side one can consider the species to be autochthonous in the Po basin as far as the Isonzo river to the North, and in rivers influenced by Po outlets to the South. Tortonese (1969) records the subspecies from the Reno river. Penso (1940) mentions the presence of bleak in Ancona province (Marche region) under the popular

name of «avola», and this vernacular name is also used in Toscana region (Tortonese, 1970). Thus we can consider the probable original southern limit of the range on the Adriatic side as Ancona Province. In rivers flowing on the Tirrhenian side of Italy, the species is absent in Liguria (Arbocco, 1966), Umbria (Silvestri, 1892) and Lazio (Vinciguerra, 1889) regions. In Toscana region the species was reported in the Arno and Ombrone rivers by Canestrini (1874) and Scotti (1898). The presence of bleak in the Ombrone river was first mentioned by Dei (1871), but D'Ancona (1934) did not find the species and gave only the popular name of «albo» for a supposed bleak living in that river. Nevertheless, when populations of *Alburnus* are present, they cannot be missed. Thus we can conclude that the presence of the species in the Ombrone river was not confirmed and possibly it was introduced in recent times. The acclimatized population of bleak from the Paglia river (a tributary to Tiber river) are true *A. a. alborella*. My findings do not differ from those of Festa (1892), Manfredi (1916) and Tortonese (1970). The original range of *A. a. alborella* is illustrated in Fig. 3.

Outside of Italy *A. a. alborella* lives in Dalmatia and Albania (Berg, 1932). This subspecies was also reported by Karaman (1924) in Macedonia in Lake Ohrid. However, one can compare my *A. a. alborella*, as well as those of Festa, Manfredi and Tortonese, with the Ohrid bleaks of Oliva (1950), and Dimovsky and Grupce (1971, 1975). These last two authors gave the following ranges and means for scales on the lateral line : 47-55, mean 50.68 (100 specimens) ; Oliva : 48-52 (16 specimens). In my specimens it was 42-51, mean 46.03 ; Festa found 44-49 (no mean state) ; Tortonese found 42-51 (no mean) ; and earlier I found (Bianco, 1978), 42-52, mean 45.03 (45 specimens). In his original description, De Filippi (1844) counted 42 lateral line scales. One can conclude that the population from this lake does not belong to the subspecies *A. a. alborella*, the bleaks from Lake Ohrid usually having 5 scales more on the lateral line than *alborella*.

The population of bleak from Scutari lake (Albania) is assigned to the subspecies *alborella* in accordance with the data given by Steindachner (1882), who counted 44-45 lateral line scales. This lake represents the southern limit of range of *A. a. alborella* for the Iliric-Adriatic province (see Fig. 3).

REMARKS ON ALBURNOIDES FROM GREECE

According to Daget *et al.* (1977), two subspecies live in eastern Greece : *Alburnoides bipunctatus thessalicus* Stephanidis, 1950, from the Sperchios to Axios rivers and *A. b. strymonicus* Chickoff, 1940, from the Strymon to Nestos rivers. I assigned my specimens from the Pinios river to the subspecies *thessalicus*, but some questions arise about the pharyngeal tooth formula. The more frequent disposition observed by Daget *et al.* was 2.5-5.2 ; in all my specimens it is 2.5-4.2. I considered mine as *thessalicus* on the basis of other meristic counts and because the Pinios river is in the range given by Daget *et al.* for *thessalicus*.

The two specimens collected by the author from Joannina lake have the for-

mula 2.5-5.2 and differ from those of Pinios both for teeth and head and caudal peduncle lengths (see Tab. II). In northern Greece and Macedonia live two other subspecies : *A. b. prespensis* Karaman, 1924 and *A. b. ohridanus* Karaman, 1928 from Prespa and Ohrid lakes. Dr Risto Grupce very kindly sent to me data on pharyngeal teeth of both populations : 100 spec. from Ohrid, 82% 2.5-4.2, 11% 2.5-5.2, 7% other ; 99 spec. from Prespa, 62% 2.5-4.2, 37% 2.5-5.2, 1% other. On the basis of pharyngeal tooth formulae alone we cannot ascribe my *Alburnoides* from Joannina to either of the two latter subspecies until a revision of *Alburnoides bipunctatus* group of subspecies is carried out.

May be that bleaks from western Greece (up to now only three localities were reported : mine from Joannina lake and according to Stephanidis (1974) the Korytos river near Kypseli village and the Aoos river near Konitsa) belong to a subspecies other than *thessalicus* and *strymonicus* because if two different subspecies live in the same Aegean side, possibly another lives in the rivers of the opposite (Ionian) side of Greece. In fact this region has a different paleogeographical history than that of rivers flowing into Aegean Sea.

Tabl. II — Mean value of measurements expressed in % of standard length in *Alburnoides bipunctatus* ; in parenthesis \pm standard deviation.

CHARACTER	A.E. <i>bipunctatus</i>	A.E. <i>thessalicus</i>	A.E. <i>elohridi</i>	A.E. <i>joannina</i>	
Space					
Preorbital	7.43(0.36)	7.32(0.72)	7.56(0.48)	7.69	7.55
Interorbital	8.77(0.45)	9.26(0.47)	9.43(0.54)	9.23	8.68
Predorsal	53.28(1.49)	55.32(0.85)	56.17(0.66)	54.15	53.40
Preventral	47.50(1.13)	48.86(1.16)	49.48(1.65)	49.54	49.24
Length					
Head	25.88(0.88)	26.82(0.66)	28.06(1.22)	29.54	28.49
Mouth	7.87(0.70)	8.67(0.55)	8.57(0.88)	7.69	8.30
Caudal peduncle	16.49(1.15)	16.75(1.03)	16.26(1.47)	18.46	18.87
Dorsal fin	25.26(1.23)	26.71(1.91)	28.42(0.84)	23.23	25.66
Anal fin	20.26(0.86)	20.81(1.28)	21.05(1.46)	18.92	19.81
Ventral fin	16.86(1.22)	17.65(1.53)	19.08(0.94)	15.85	18.30
Depth					
Head	19.35(0.63)	20.31(0.64)	21.46(0.36)	20.46	19.06
Body	25.29(1.80)	26.41(1.61)	31.62(2.55)	29.23	23.96
Caudal peduncle	10.44(0.47)	11.96(0.48)	14.05(0.81)	11.85	10.75
Distance					
P - V	22.51(1.26)	24.23(1.26)	23.30(1.23)	24.31	23.21
V - A	19.33(1.52)	20.26(1.12)	19.11(1.01)	19.85	20.19
Eye diameter	8.25(0.41)	7.98(0.65)	7.95(0.63)	7.69	8.49

Alburnus alburnus alborella differs from *A. albidus* in having a more compressed head, slender body, mouth terminal but moderately upturned, no pigment spots on lateral line and on the rows of scales below, more gillrakers and more branched rays in the anal and pelvic fins.

In comparison with *Alburnus alburnus alburnus*, *A. albidus* presents the same divergences as observed for *A. a. alborella*, but they are much more marked. I find no overlap in ranges of variability of gillrakers and branched rays in the anal fin. In *A. albidus* the number of branched rays of the pelvic is usually 7, in *Alburnus alburnus* 8. In % of SL there is no overlap in mean \pm standard deviation of inter-orbital space and head depth.

The most striking difference, however, concerns the position of the mouth, first observed by Sommani (1951), between *Alburnus alburnus alborella* and *Alburnus albidus*. In *Alburnus alburnus alburnus* a line from the middle of the caudal peduncle to the opening of the mouth touches the iris of the eye in its upper portion; in *A. a. alborella* it goes through the middle of the pupil, while in *A. albidus* this line touches the lower part or crosses the eye below the pupil (well upturned, moderately upturned and not upturned mouth respectively). In *Alburnoides* the line crosses the eye as in *A. albidus* (Fig. 2, from A to D). I consider this change

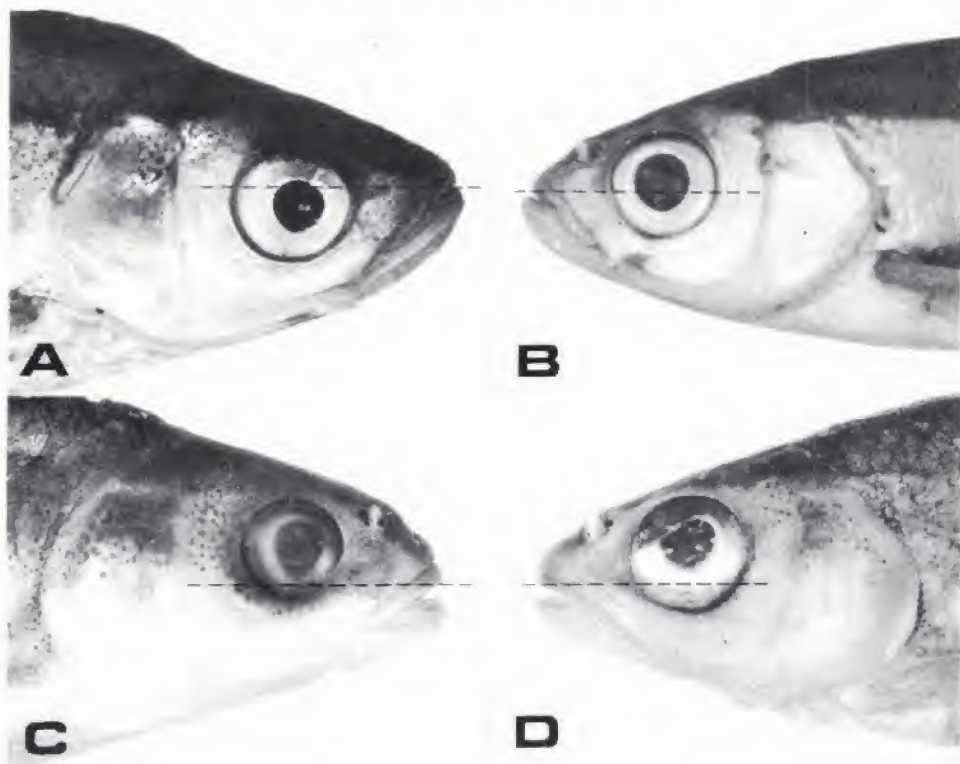


Fig. 2. — Mouth position in three species of bleak : A, *Alburnus alburnus alburnus* (well upturned) ; B, *Alburnus alburnus alborella* (moderately upturned) ; C, *Alburnus albidus* (not upturned). The situation of C is similar to that of *Alburnoides bipunctatus* (D).

in mouth position as to be direct consequence of adaptation to different kinds of feeding. *A. a. alburnus* is mainly planktophagous. The diet of *A. a. alborella* is mixed (plankton, benthos and algae), as shown by Giussani & Grimaldi (1975). The food of *A. albidus* consists only of benthic elements, detritous and algae (Bianco, 1978). It can be noted that the northern European lakes and river basins are larger and colder than those of northern and central Italy and the plankton communities are well developed in nearly all seasons. In northern Italy, as a consequence of recent eutrophication of the lakes (Giussani & Grimaldi, 1975), the large-sized planktonic populations of such cladocera as *Daphnia*, *Bythotrephes* and *Leptodora* are increasing and the planktophagous fishes prefer this kind of food rather than non-pelagic zoo-organisms. Thus, in the absence of plankton, the bleaks would tend to obtain food from other sources. The extreme situation is observed in bleaks from southern Italy, where the rivers are small and short and there are no large lakes. The ventral gape position of the mouth in *A. albidus* is therefore the result of adaptation to a benthic kind of food.

The cline observed by Petrov (1930) for the number of branched rays in the anal fin in populations of *Alburnus alburnus* from North to South Europe, was found also by me (Tab. IV). The same cline was observed for number of gillrakers that decreases in populations of *Alburnus* from North to the South (Tab. V). However, the structure of the gillrakers is directly connected with feeding habits, being more numerous and longer in planktophagous fishes. Conversely, many proportional values increase from North to the South. The head becomes deeper and thicker from *A. a. alburnus* to *A. a. alborella* and *A. albidus* (Tab. I).

The cline observed for *Alburnus* is reported in *Alburnoides bipunctatus* in respect to branched anal rays. Data on this character obtained by me (Tab. IV) and from other sources (Olivia, 1950; Abdurakhmanov, 1962; Banarescu, 1964; Dimovsky & Grupce, 1972; Daget *et al.*, 1977), show the following gradation in populations of *Alburnoides bipunctatus* subspecies from North to South (mean values): *rossicus*, 15-16; *bipunctatus* and *kubanicus*, 14-15; *fasciatus*, 13-14; *eichwaldi*, 12-13; *ohridanus*, 11-12; *prespensis*, 10-12; *A. bipunctatus* from western Greece, 11-13; *smyrneus*, 14-15, (according to Pellegrin, 1928). The last subspecies represents an exception to the rule.

Because of the several resemblances between *Alburnus albidus* (vestigial black spots along lateral line, mouth position, mean value of many body proportions) and *Alburnoides bipunctatus*, it seems that *A. albidus* is a species still in the course of evolution due to the instability of ecological conditions in the rivers from South Italy. We can suppose that the end of this evolutionary process, will be a similarity to the body shape of *Alburnoides* as a result of adaptation to life in small rivers. As mentioned, the observed plasticity of many characters in *Alburnus* are not found in *Alburnoides*. Thus we can assume that *Alburnoides* is the non-planktophagous and non-reversible version of *Alburnus* from which it was derived, its characters being more fixed as in other non-planktophagous cyprinids (e.g. *Leuciscus* and *Barbus*).

CONCLUSIONS

The genus *Alburnus* has a disjunct range in Italy as illustrated in Fig. 3. This separation is not due to a bipolar range, but it is the result of a «two-way» migration of ancient forms. This statement is supported by the land connexions that occurred between southern Italy and balcano-dalmata areas in ancient times, as illustrated by Pasa (1953). This land-bridge, from Pleistocene up to Pliocene, was several times interrupted and then re-established, the ancient Adriatic Sea being either an open gulf or a salty lagoon and thus a barrier to the migration of cyprinids and other primary-division freshwater fishes (*sensu* Darlington, 1957). This explains the absence of *Alburnus* in central Italy. However other cyprinid fishes are present in this region, thus we can suppose that the expansion-capacity of genera like *Leuciscus*, *Rutilus* and *Barbus* (well represented in central Italy) is more pronounced than *Alburnus*.

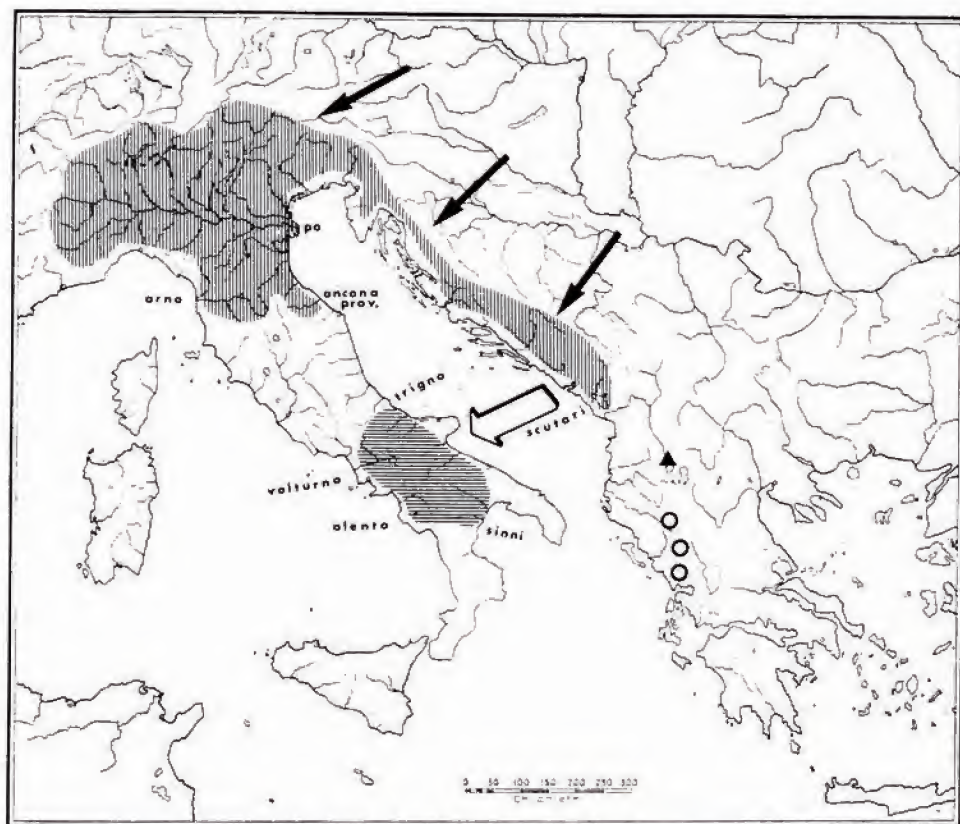


Fig. 3. — Distribution of *Alburnus alburnus alborella* (vertical hatching), *Alburnus albidus* (horizontal hatching). Black arrow : migration route of ancient bleak. White arrow : way by which *Alburnus* reached South Italy. Triangle : new population of *Alburnus alburnus* (Ohrid lake). Circles : localities of *Alburnoides bipunctatus* in West Greece.

The most ancient fossil record of *Alburnus*, according to Romer (1966), was dated Miocene from eastern Europe. One can suppose that the first penetration of this genus into northern Italy occurred, as a result of radial dispersion from eastern Europe, before the formation of the alpine chain that separates northern Italy and the Illiric-Adriatic province from the rest of Europe. Possibly *Alburnus* at this time (lower Miocene) reached the southern Adriatic areas of Italy by means of the bridge already mentioned. Nevertheless, it is possible that the migration occurred in more recent times, perhaps in Pliocene.

It is interesting to speculate whether other cyprinids crossed this bridge in ancient times. Thus some of the North Italian species of *Leuciscus*, *Barbus* and *Rutilus* also live in southern Italy, although in many cases there is now an overlap in the range of southern (entered by the land-bridge) and northern (entered before or during Alps formation) species. Possible confirmation comes from recent research on specimens of *Barbus* collected in rivers where *A. albidus* lives. These *Barbus* are not true *Barbus barbus plebejus*, differing from them in colour pattern and in the absence, in adults, of posteriorly denticles on the thick last unbranched dorsal ray, although in some cases vertigial denticles are present near the base. In young specimens the denticles are, on the contrary, well developed. It may be that this *Barbus* is an intermediate form between *B.b. plebejus* and *Barbus meridionalis* or *Barbus graecus*, but to confirm this supposition one needs to compare different populations of *Barbus* from several rivers from northern and southern Italy. The same thing carried out on *Leuciscus* might resolve the suspected presence in Italy of a species different from *Leuciscus cephalus cabeda*.

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